and fat. But there were also concerns that a higher-fat MR would increase the incidence of scouring especially in warm weather, and also reduce pre-weaning grain consumption. During the late summer and fall of 2002 forty-eight heifer calves were paired by birth weight and fed either the regular MR, or a high-fat (17% protein, 28% fat or 2.1% protein, 3.6% fat on as-fed basis) MR. The calves were housed outside in individual hutches and fed 2L MR twice a day until weaning at 7 weeks of age, when they were weighed again. They received free-choice water, grain and hay. Grain intake was tracked weekly and environmental temperatures were monitored daily. The frequency and duration of scouring and treatments were recorded daily. The weight gained from birth to weaning was significantly higher in the high-fat MR group (43.55 kg vs. 31.76 kg; p≤ .001). The % of birth weight gained by the high-fat MR group was also significantly higher (105% vs. 75%; p≤ .001). There were no significant differences in grain intake by either group (2.26 kg/d). The cost of feed intake was less in the high-fat MR group by $.02 per calf per day. Although the environmental temperature ranged from 37.1°C to -7°C during the trial period, there were no significant differences in the incidence or duration of scouring (8 cases/group, treated for 3 d). The data from this pilot study suggests that high-fat MR can be cost-effective to feed to calves even during warmer months resulting in higher weight gains with no reduction in grain consumption, and with no increased incidence of scours.

Key Words: Calf raising, High fat milk replacer, Weight gain

690 Evaluation of intensified liquid feeding programs for dairy calves. B. C. Pollard*, H. M. Dann, and J. K. Drackley, *University of Illinois, Urbana, IL*.

Our objective was to compare growth between two intensified liquid feeding programs (E) and a conventional early weaning (C) program. At 3 d of age, female Holstein calves in individual hutches were assigned to C (milk replacer [MR; 22% CP, 20% fat] plus starter [18% CP], as fed) or E (MR [28% CP, 20% fat] plus starter [22% CP], as fed). Trial 1 used 12 calves on C (C1) and 11 calves on E (E1). For E1, calves were fed MR at 2% of body weight (BW) during wk 1 and 2.5% of BW during wk 2-5 (adjusted weekly). During wk 6, calves were fed half the amount offered during wk 5 and were weaned at the end of wk 6. In trial 2, 21 calves received each diet (C2 and E2). For E2, calves were fed MR powder at 2% of BW during wk 1 and 2.5% of wk 2 BW during wk 2-5. During wk 6, calves were fed half the daily amount offered during wk 2-5 and were weaned at the end of wk 6. In both trials, C calves were fed a constant amount of MR (1.25% of birth weight as powder) through wk 4, one-half of that amount during wk 5, and were weaned at the end of wk 5. All calves had ad libitum access to water and starter. Total MR consumed was greater (P¡0.01) for E (16.4, 38.9, 16.3, and 40.0 kg DM for C1, E1, C2, and E2, respectively). Total starter intakes through wk 8 were lower (P¡0.01) for E (49.8, 22.4, 54.1, and 25.3 kg). In trial 1, BW (57.0 vs 47.0 kg) and heart girth (HG) were greater (P¡0.01) for E1 at wk 4; at wk 8 body length (BL) was greater (P¡0.01), and wither height (WH) and HG tended (P¡0.10) to be greater, for E1. In trial 2, BW (63.5 vs 51.1 kg), BL, and HG were greater (P¡0.01) for E2 at wk 4 and tended (P¡0.10) to remain greater at wk 8. Average daily gain (ADG) was greater (P¡0.01) for E in both trials through wk 4 (0.303, 0.709, 0.360, and 0.714 kg/d for C1, E1, C2, and E2, respectively) and through weaning (0.519, 0.747, 0.562, and 0.671 kg/d). The ADG through wk 8 was greater for E1 than for C1 (0.690 vs. 0.560 kg/d, P¡0.01) and tended (P¡0.08) to be greater for E2 than for C2 (0.671 vs. 0.591 kg/d). Intensified liquid feeding programs resulted in greater early gains of BW and frame.

Key Words: Calves, Growth, Milk replacer

691 The effect of cobalt supplementation in free choice salt on fiber digestion by cattle. L. J. Odens*, C. L. Steigert, J. J. Michal, K. A. Johnson, and R. L. Kincaid, [1]*Washington State University, Pullman, WA*.

The objective of this study was to determine the intake of cobalt (Co) that optimizes fiber digestion in a ruminant. Four ruminally fistulated cows were fed a diet of approximately 50(BGS). Treatments were arranged according to a Latin square design in which each cow was fed a trace element salt that contained 0, .5, 4 , or 10 ppm of added Co. Squares were randomized to avoid a carry-over effect when the next concentration was applied. The Co concentrations were achieved by adding cobalt glucoheptonate to a basal mineralized salt. Cows were adapted to each treatment for 7 d, ruminal fluid was collected (approximately 4 h after feeding) and transported to the laboratory to be used as an inoculant for the Daisy Incubator (ANKOM Technology). To examine dry matter and fiber digestion, the forage used in the diet was collected, dried at 60 C, ground through a 1 mm screen, weighed into small bags and placed into the incubator. Ground alfalfa hay (AA) was used as a reference standard. After 48 h, the incubation was ended; the bags were washed and dried at 100 C for 4 h to determine dry matter disappearance (DMD). Duplicate incubations from each cow at each Co level were conducted. The content of neutral detergent fiber (NDF) in the dry residue was determined. The impact of cobalt level on in vitro ruminal digestion of DM and NDF was evaluated using the SAS statistical package for a Latin square. Salt was fed free choice and intakes varied dramatically by cow. Preliminary evidence suggests Co intake had no effect on DMD or NDF disappearance (NDFD). Mean DMD was 58BGS and 5238fiber digestion.

Key Words: Cobalt, Fiber digestion, In vitro

692 The costs and returns associated with select Wood Model lactation lengths. E. A. Vaaler* and G. L. Hadley, [1]*University of Wisconsin-River Falls*.

The objective of this study is to determine the costs (returns) associated with extended days open and longer lactation lengths using curves developed by the Wood Model. Production profitability is at the heart of dairy farms. Therefore, the importance of this study is enabling the producer to select the lactation length that captures the highest return. Curves were developed for five calving intervals (40, 44, 48, 52, 56 weeks) for each of the three lactations (1, 2, 3). Costs include breeding, housing, labor, and feeding, as well as, other costs associated with the lactation. Cost, revenue, and profit were determined on a per day basis. They were also determined using the University of Wisconsin-Extension and Center for Dairy Profitability Agricultural Financial Advisor (AgFA) farm financial records database. The Net Present Value (NPV) associated with each series of lactation was calculated. To account for the different time frames, each lactation series was replicated to infinity by converting the NPV to an equivalent annuity. By applying a profit function to a Wood Model of various lactation lengths, we found that the cost of an average day open increases as lactation length increases. The return to the farm decreases as lactation length increases. Therefore, if a farm's lactation curve is similar to those generated by the Wood Model, these results mean that a farm should decrease lactation length (calving interval) to increase return.

Dairy Production Undergraduate Paper Presentations

693 Effects of seasonality on the incidents of double ovulation in lactating Holstein cows. K. L. Genho*, R. W. Silcox, and D. L. Eggett, *Brigham Young University*.

Twinning has a dramatic negative effect on subsequent health and reproductive performance of dairy cattle. Double ovulation is the primary cause of twinning. A study was conducted to evaluate the effect of seasonality on the incidence of double ovulation in lactating dairy cows. The study, designed to evaluate the effect of season (summer versus winter) on the incidence of double ovulation, utilized 590 non-pregnant, high producing (¿42 kg/day) Holstein dairy cows located at two different farms under similar management practices owned by a single entity. Observations took place in July-August (summer) and January (winter). There were 315 cows observed in summer and 275 cows observed in winter. The ovaries of each cow were examined once using a Corometrics 500V ultrasound machine to determine the number of corpora lutea present. Overall ovulation rate was not affected by location or lactation number (P¿.05), so data were pooled. Incidence of double ovulation was affected by days in milk (P=.0382) and by rate of milk production (P=.0061). In addition, season was found to have an effect (P=.0113) on the incidence of double ovulation (22.2%) in this experiment. How-

ever, in this study the number of double ovulations was higher in the winter months (25.7%) versus the summer months (18.2%).

Key Words: Dairy cattle, Double ovulation, Seasonality

694 Are Dogs "Man's Best Friend" or "Cattle's Worst Enemy?". Jessica Carrey*, *Louisiana State University*.

Abortions in dairy cattle represent a significant loss of potential income and present a frustrating challenge to dairy producers and veterinarians. Abortion in dairy cattle is defined as a loss of the fetus between 42 and 260 days of gestation. It has been estimated that each abortion costs dairy producers $500 to $900 depending on factors such as value of replacement heifers, feed and milk prices, and the stage of gestation when the abortion occurs. Genetic abnormalities, heat stress, and toxic agents such as mycotoxins have been implicated as factors which may cause abortion. The most frequent causes of abortions in dairy cattle are bacterial and viral infections. However, Neosporosis is a parasitic disease that can trigger spontaneous abortions in many species, including dairy cattle. This infection is caused by the coccidian protozoan parasite *Neospora caninum*. This organism is transmitted by dogs that ingest infected tissues from aborted fetuses and shed the parasite eggs, or *Neospora* oocysts, in their feces. Dairy cattle are exposed to this organism when they ingest feed contaminated with the dog feces. *Neospora caninum* was not identified until 1988, but its economic impact has already become extensive throughout the United States and the world. Although there is no treatment for Neosporosis, a vaccine has recently become available. Good management practices, including pest management, removal of aborted fetuses and placentas, and vaccination protocols, may prove to be beneficial in the prevention of this costly problem in the dairy industry.

Key Words: Neosporosis, Dog, Dairy cattle

695 Crossbreeding in the dairy industry: A new era in dairy production. L. B. Core*, *University of Kentucky*.

Crossbreeding is as controversial today as it was in the 1930's when the first studies were conducted. Although, Holstein generally have a higher lactational performance, crossbreeding tend to offer other benefits to the producer. Lifetime yields, growth, health and reproductive traits are positively impacted by crossbreeding. An Illinois crossbreeding study reported that crossbred dairy cows had a 14.9% higher per cow income and 11.4% higher per cow per year income. A Canadian study reported equivalent lifetime milk yields, milk value and net returns for Crossbred and Holstein cows. Additionally, heterosis of 15 to 20% for lifetime traits was observed. Many studies indicate that a two breed rotational crossbreeding system is the most profitable. A three breed system has been examined , however evidence for its profitability is yet to be determined. The information cited does not prove the profitability of crossbreeding. More research is needed which includes current U.S. genetics, current market values, and multi-generation economic comparison. Many researchers agree that straight breeding eliminates the ability to utilize the positive attributes of all dairy breeds. Cross breeding may be the answer for dairy producers to maximize economic merit.

Key Words: Crossbreeding

696 Organic dairy production: Past present and future. W. T. Wencl* and S. C. Kelm, *University of Wisconsin -River Falls*.

Organic agriculture has emerged as a developing market for dairy farmers. Both supply and demand for "certified organic" food products have risen dramatically over the past 20 years. Hundreds of certifying agencies emerged across the United States to verify the authenticity of the many products farmers and ranchers were producing. Cooperatives also formed as producers realized the importance of marketing products to consumers, the most important part of the equation. As the markets continued to develop producers and consumers realized that change was needed to better define the term "organic". The many different certifying agencies that developed all had slight variations in their certification requirements; European standards were also different. Such differences caused problems with trade and general consumer confidence in the label, causing confusion as to what the term organic means. A solution to this problem was to develop a national organic standard and this project was assigned to the USDA as part of the 1990 Farm Bill containing the Organic Food Production Act. National Standards were presented on December 20, 2000 and were implemented in October 2002. These standards will greatly affect this industry as it grows in the future.

Key Words: Organic, Standards

697 Effects of photoperiodic manipulation of dairy cattle. G. Brauning, III*, *Virginia Tech, Blacksburg, Virginia*.

The modern dairy producer has multiple management techniques that can be used to stimulate milk production. Changing milking frequency from 2X to 3X, supplementation with bST, and now photoperiod manipulation, are examples of tools that can be used to stimulate production. A natural photoperiod consists of 13 or fewer hours of light/day. A long day photoperiod (LDPP) is 18 hours of light/day, followed by 6 hours of dark. LDPP has been shown to increase milk production by up to 3.3 kg/day. In most studies, milk composition has not been altered, but minor decreases in fat concentration in milk have been documented with LDPP. Continual lighting is not recommended, as a dark period is required to maintain the ability of the animal to track day length and consequently regulate bodily functions. In order to observe milk yield increases, a footcandle illumination of 20 footcandle illumination per 50 feet of barn length is suggested. While the mechanism behind the increased milk yield with LDPP is not clear, LDPP affects the melatonin concentrations in the blood. Melatonin regulates plasma IGF-1 and serum prolactin concentrations. Research points to IGF-1 as the most probable cause of increased production with LDPP. Producers can combine bST supplementation and LDPP for an additional production increase. Additional fat corrected milk production increases from 1.9 kg/day with LDPP, to 5.7 kg/day over control when LDPP is combined with bST. Photoperiodic manipulation has the potential to be an important tool for dairy producers. While there are fixed costs to implement LDPP, and power usage increases, most producers find LDPP to be a profitable management tool. No additional effort is required on a daily basis to gain the effects of LDPP, no injections need to be administered, and there is no additional labor involved.

Key Words: Photoperiod

698 Crossbreeding in the dairy industry: why now? J. D. Hushon* and D. R. Olver, *Pennsylvania State University*.

Researchers and companies have spent extensive time and investment looking at how changes in environmental factors impact milk production in dairy cows. However, it must be noted that milk production is the result of both genetics and environment. With that in mind, producers are exploring new ways that genetics can impact the dairy industry that is seeing a decline in herdlife. This decline is being partially blamed on the growing problem of a gradually more and more inbred national dairy population. One possible solution is crossbreeding. Crossbreeding has been used for hundreds of years in other areas of agriculture. In the dairy industry, only recently have studies begun to look again at this using crossbreeding. In fact, a recent study by the USDA on Holstein sires crossed with Ayrshires, Brown Swiss, Guernseys, and Jerseys, showed heterosis effects to vary between 2.47.5led to the renewed interest in this age-old technique. These factors include a shift from volume based milk pricing to component based milk pricing, and increased concerns about inbreeding, efficiency and fertility. It will also examine uses of crossbreeding internationally and explore how dairy producers in the United States, especially large commercial producers, can utilize those results.

Key Words: Crossbreeding, Genetics

699 Utilizing milk forward contracting as a risk management tool. V. Ahlem*, *California Polytechnic State University, San Luis Obispo*.

As the dairy industry enters the years ahead, producer will be faced with numerous challenges, such as tightening of environmental standards, rising fees for waste management programs, loss of land to urban sprawl, and an uncertain milk price. As we move forward and face these challenges, budgets will tighten and profit margins can begin to slip if not managed correctly. One-way to help manage this cycle is to use milk forward contracting options to mitigate drastic price swings. By doing so a producer can lock in a price that he/she will be able to turn a profit on. Many details must be evaluated before even considering forward contracting as an option, such factors as current cost of producing

a hundredweight of milk, knowledge of where the market has been and where it might be headed, and most importantly, a willingness to live with the decisions once they have been made. Forward contracting of milk has long been an untapped resource, due to the fact that we operate in a capitalistic society, and the complex steps that must first be taken to understand the full financial implications as they are related cost of production. The time has come for the dairy industry to start taking advantage of such tools as forward contracting to minimize risk and become more efficient.

Key Words: Forward contracting, Milk pricing, Risk management tool

Dairy Foods Undergraduate Paper Presentations

700 Dairy case wars: "got milk?" vs. "not milk?". J.H. Krall*[1] and D.R. Olver[1], [1]*Pennsylvania State University*.

Many supermarkets currently display both soy "milk" and dairy products on the same shelves. However, is soy beverage actually milk? Obviously it is not produced by a lactating mammal. For this reason, the National Milk Producers Federation (NMPF) filed a trade complaint with the Food and Drug Administration to prevent the labeling of soy beverage as milk. According to federal guidelines, some requirements for a beverage in its final packaged form to be labeled as milk include lacteal secretion from healthy cows, pasteurization, and contents of at least 8.25fat. Since the ingredient soy protein is not listed in this regulation, the NMPF argues that soy products cannot be labeled as milk. Soy industry officials respond that milk is a generic term attached to many products. According to a California research firm, sales of refrigerated soy milk in traditional supermarkets increased by 57October 31, 2001. Some speculate that a portion of this increase is due to consumers erroneously associating dairy's wholesome image and health benefits with soy because of the soy "milk" label. The resolution of this issue by FDA will be seen in supermarket dairy cases nationwide.

Key Words: Soy milk, Dairy products

701 Phage peptide inhibition of phage infection in cheese fermentation. J. Woodcock*, *University of Kentucky*.

Bacteriophages (phage) are viruses that infect bacteria by injecting their genetic material into the bacteria cell. Phage are commonly found in milk products and can affect manufacturing by destroying culture bacteria necessary for the formation of cheese and other fermented products. Phages lock onto a bacterial cell membrane by attaching a protein to a receptor site on the prokaryote. In particular, the c2 phage adsorption protein binds with the bacteria Lactococcus lactis ssp. lactic c2, creating an irreversible lock. By utilizing competitive inhibition, in which the receptor sites on the host bacteria are blocked by c2 phage peptides, the rate of phage proliferation is reduced.. With this reduction, cheese production and efficiency can increase. Considering the simplicity of introducing a phage to a cheese plant by clothing, cheese whey, and even mist, phage peptide inhibition could allow sufficient time for cheese fermentation without risk of phage infection.

Key Words: Phage Peptide, Bacteriophage, Cheese Fermentation

702 Will the "Real" Milk Please Stand Up? L. Ward, *Louisiana State University*.

In October, 1999, the FDA stated that "it recognizes the health benefits of daily consumption of soy protein. Specifically, consuming 25 grams of soy protein daily can help reduce the risk of heart disease." This announcement paved the way for the soy product market. One product that has been gaining in popularity is soy milk. Soy milk is high in protein, rich in vitamins and minerals, low in fat, and cholesterol free. It contains no lactose, which makes it a safe and nutritious alternative for lactose intolerant individuals. Research has shown that soy foods may help to prevent heart disease and some forms of cancer. This beneficial effect is possibly due to isoflavones, a phytoestrogen found in soybeans. While soy milk has numerous potential health benefits, it is not "nature's most nearly perfect food." Soy milk has been reported to be unpalatable. Sensory experts have reported off flavors, bitter taste, chalky mouth feel, and a bad aftertaste. With milk consumption declining and the soy milk market getting larger, the dairy industry must work harder to promote the health benefits of milk. Milk and dairy products have numerous health benefits because of their high concentrations of calcium, protein, vitamins, and minerals. The dairy case also has a full line of products for lactose intolerant individuals. In choosing their milk, consumers must be the judge. They can select a bad tasting product with health claims, or they can opt for "real" milk with its great taste and many nutritional benefits.

Key Words: Milk, Soy, Health benefits

703 Wazzu's famous variety. J. DeVoe*, *Washington State University*.

Cougar Gold is a unique cheese made only by Washington State University Creamery in Pullman, WA. This cheese was developed in the 1930's with a unique bacterial strain giving it its own particular taste. To this day the same strain is cultured every three days, derived from the same clone that was selected over seventy years ago. Cougar Gold is a sharp, white cheddar with a taste that resembles Swiss or Gouda and it is aged for at least one year. This cheese is packaged in a can, because of research in the 1930's for a more ideal packing medium. Cougar Gold is the only known cheese in the USA that is canned, therefore making it Washington State's own unique cheese. The scarcity of Cougar Gold also adds to its uniqueness. The only way to get this cheese is either to make a trip to Pullman or to have it mail ordered. It is not shipped in mass quantity and anyone ordering it can only order twenty cans at a time. Therefore, not only is this cheese unique, but it's supply is restricted. The WSU Creamery makes this cheese year round and produces a little less than 150,000 cans of Cougar Gold a year. To add to its singleness, Cougar Gold helps to support student employment in the WSU Creamery. Furthermore, the facility provides opportunities for students to work with and learn about cheese. For example, the Food Science Human Nutrition club works with the cheese for a fund-raiser, students from the food science department hold classes and graduate and undergraduate students hold research studies at the Creamery. Therefore, a can of Cougar Gold is not just a plain old can of cheese; it is unique and represents many years of support, education and quality.

Key Words: Cougar Gold, Cheese

704 On-farm dairy processing: Opportunity for diversification of small farms. E. Moss*, *Virginia Polytechnic Institute and State University*.

To better compete in the changing dairy industry, many small dairy producers are considering diversification. One diversification strategy that is growing in popularity is on-farm processing of fluid milk, cheeses, and other dairy products. There are currently 13 registered on-farm creameries in the state of Virginia. Many of these farms are family run and owned. These operations produce their own milk from small milking herds and turn the raw product into a "cow to consumer" product. The start up cost for the typical Virginia on-farm processing operation varies from $1 million to $1.5 million. Examples of products manufactured at these creameries include several flavors of milk with varying fat content, specialty cheeses, yogurts, and chip dips. On-farm processed dairy products are often, but not always, produced organically, and are promoted as being of excellent quality and freshness. On-farm processing of dairy products offers a new technological twist on the old-fashioned concept of diversified farming. Homestead Creamery and Shenville Creamery in Virginia are two examples of small dairies that are competing by processing their own fluid milk. Both of these creameries use Pladot^{TM} Mini-Dairy, an Israeli-made milk processing system that includes a cream separator and cheese-curding tank. These systems are made especially for small-scale operations with from 30 to 300 cows. Homestead and Shenville use traditional glass bottles, offers home delivery, and charge a premium for their product. A half-gallon of Homestead Creamery whole milk retails for $4.19 at grocery stores including $1.50 deposit that is refunded upon return of the glass bottle. This compares to $2.99 for a gallon of milk in a regular plastic jug.